CLAIMS

1. A method for detecting defects in, and/or geometrical characteristics of, at least one joint or splice of sheet pieces, in a unloaded state, characterised by the following steps:
    a. subjecting said joint or splice to a non-unidirectional electromagnetic radiation;
    b. performing a two-dimensional detection of the radiation reflected or refracted by said joint or splice;
    c. generating output signals corresponding to said two-dimensional detection;
    d. determining possible defects or the geometrical characteristics of at least part of said joint or splice, by analysing said output signals.
2. A method according to Claim 1, characterised in that said radiation is directed both above and below said joint or splice and the radiation reflected or refracted by the joint or splice is detected both above and below said sheet pieces.
3. A method according to anyone of the preceding Claims, in which said sheet pieces are rubber or other flexible material sheets.
4. A method according to anyone of the preceding Claims, wherein said sheet pieces are stopped when said at least one joint or splice of said pieces is placed in correspondence to at least one source of non-unidirectional electromagnetic radiation and to at least one sensor which is able to perform a two-dimensional detection of the radiation reflected or refracted by said joint or splice, the sheet pieces being moved again after said steps of subjecting said joint or splice to a non-unidirectional electromagnetic radiation and of performing a two-dimensional detection of the radiation reflected or refracted by said joint or splice are accomplished.
5. A method according to anyone of the preceding Claims, wherein said steps of subjecting said joint or splice to a non-unidirectional electromagnetic radiation and of performing a two-dimensional detection of the radiation reflected or refracted by said joint or splice are accomplished after the step of detecting the transit of said at least one splice or joint in correspondence to at least one source of non-unidirectional electromagnetic radiation and to one or more sensors for performing said two-dimensional detection.
6. A method according to anyone of the preceding Claims, characterised in that the output

signals are digital signals or analogical signals subsequently converted in digital signals, said method being characterised in that said step of analysing the output signals comprises treating said output signals by means of a convolution mask, or a Sobel filter, or a profile detector, or a blob analysis or a Fast Fourier Transformation (FFT), or a derivative analysis.

7. A method according to anyone of the preceding Claims, characterised in that said output signals of said two-dimensional detection correspond to an image of at least part of said joint or splice.
8. A method according to Claim 7, wherein said output signals are digital or digitalised signals, and said analysis of the output signals includes a first step of detecting the edges of the objects in said image, and a subsequent step of measuring and/or analysing at least one of said edges.
9. A method according to anyone of the preceding Claims, characterised in that said analysis of the output signals comprises the step of determining the respective locations of the end edges of the sheet pieces involved in said at least one joint or splice.
10. A method according to Claim 9, wherein the difference of the locations of the end edges of the sheet pieces involved in said joint or splice is used to determine possible defects or the geometrical characteristics of said joint or splice.
11. A method according to anyone of the preceding Claims, characterised by comprising a calibrating phase including the following steps:
    a. placing a straightedge in correspondence to at least one source of non-unidirectional electromagnetic radiation and to one or more sensors for performing said two-dimensional detection;
    b. subjecting said joint or splice to a non-unidirectional electromagnetic radiation;
    c. performing a two-dimensional detection of the radiation reflected or refracted by said joint or splice;
    d. generating calibration output signals corresponding to said two-dimensional detection;
    e. storing said calibration signals as a comparand for subsequent output signals.

12. A method according to anyone of the preceding claim, characterised in that the non-unidirectional electromagnetic radiation emitting spontaneous.
13. Apparatus for detecting defects or geometrical characteristics in joints or splices of sheet pieces in a unloaded state, according to the method claimed in any one of the preceding Claims, the apparatus comprising:
    a. at least one source of electromagnetic radiations which are suited to be directed towards at least one of said joints or splices;
    b. one or more sensors which can detect the radiation reflected or refracted by said at least one joint or splice;

    characterised in that:
    c. said at least one radiation source is a source of electromagnetic non-unidirectional radiations; and
    d. said one or more sensors make a two-dimensional detection of said reflected or refracted radiation.
14. Apparatus according to Claim 13, characterised by comprising at least one first sensor which detects the radiation reflected or refracted by the upper surface of the joint or splice, and at least one second sensor which detects the radiation reflected or refracted by the lower surface of the joint or splice.
15. Apparatus according to Claim 14, wherein at least two sensors detect the radiation reflected or refracted by the upper surface of the joint or splice, and at least two sensors detect the radiation reflected or refracted by the lower surface of the joint or splice, acquisition areas of said sensors being placed at the lateral edges of the sheet pieces involved in said joints or splices.
16. Apparatus according to anyone of Claim 14 or Claim 15, characterised by comprising at least one first source of electromagnetic non-unidirectional radiation placed above said upper surface of the joint or splice, the radiation of said first source impinging thereon, and at least one second source of electromagnetic non-unidirectional radiation placed below said lower surface of the joint or splice, the radiation of said second source impinging thereon.

17. Apparatus according to anyone of Claims 13 to 16, further comprising sensing means for detecting the transit of said at least one splice or joint in correspondence to at least one of said one or more sensors and to said at least one source of non-unidirectional electromagnetic radiations.
18. Apparatus according to anyone of Claims 13 to 17, wherein at least one of said one or more sensors is a matrix CCD or C/MOS camera.
19. Apparatus according to Claim 18, wherein said matrix CCD or C/MOS camera is a multi-level grey camera or a colour camera.
20. Apparatus according to anyone of Claims 13 to 18, wherein at least one of said one or more sensors is a combination of two or more linear CCD or C/MOS camera.
21. Apparatus according to anyone of Claims 13 to 20, wherein said at least one source of electromagnetic radiation is chosen among: infrared sources, ultraviolet sources, diffused light sources, X-Ray sources.
22. Apparatus according to anyone of Claims 13 to 21, further comprising means for conveying said sheet pieces in correspondence to said at least one source and to said one or more sensors, or vice-versa.
23. Apparatus according to Claims 22, characterised by comprising control means to regulate the operation of said means for conveying said sheet pieces in correspondence to said at least one source and to said one or more sensors, or vice-versa.
24. Apparatus according to Claim 23, wherein said control means are automatic control means.
25. Apparatus according to anyone of Claims 13 to 24, further comprising processing means for analysing the output signals from said one or more sensors.
26. Apparatus according to anyone of Claims 13 to 25, wherein the source of electromagnetic radiations emitting spontaneous.